PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
(Attorney Docket No. 02-957)

In the Application of:		)	
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	Rajamohana Hegde, et al.	)	
		)	
		)	Examiner: Juan A. Torres
Serial No.:	10/603,388	)	
		)	Group Art Unit: 2611
Filing Date:	June 24, 2003	)	
		)	Confirmation No.: 3034
For:	Method And Apparatus For Delayed Recursion Decoder	)	

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

Dear Sir:

Pursuant to 37 C.F.R. Section 1.97 - 1.99, the Applicant wishes to make the following references of record in the above-identified application. This Information Disclosure Statement is in compliance with the continuing duty of candor as set forth in 37 C.F.R. Section 1.56. Copies of the references 16-26 cited below are enclosed herewith. These references are also listed on the enclosed PTO Form 1449.

In accordance with MPEP Sections 609 and 707.05(b), it is requested the documents cited be given thorough consideration and that they be cited of record in the prosecution history of the present application by initialing on Form PTO-1449. In addition, the Examiner has requested a brief description of the references with respect to whether they disclose time-reverse path identification as described in the presently pending application. Applicants have provided such a description for the Examiner's benefit, but with the expectation that the references will be considered in their entirety as requested above.

U.S. Patent Documents

1. Sanu Mathew, U.S. Patent No. 7,131,055, Issued October 31, 2006.

This reference describes the standard Viterbi process, in which, after the final state is reached, the "best path" through the trellis is obtained by tracing back from the final state to the initial state, recording

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the bits that corresponded to each forward-step through the trellis. Because the survivor path is not identified until the other paths are eliminated and the paths merge into a single "survivor", one doesn't know which bit is decided until the process completes by deciding a final state. Once the final state is decided, one looks back at all of the ancestors of that state, tracing back it's history, and recording decisions. This does not describe time-reverse path identification as set forth in the pending application.

2. Christopher Nicol, U.S. Patent No. 7,127,664, Issued October 24, 2006.

This reference describes aspects of the Viterbi algorithm (which is MLSD – maximum likelihood sequence detection) and the forward-backward algorithm (which is MAP detection – maximum a-posteriori probability detection). First, with respect to the Viterbi algorithm, it proceeds one step at a time, starting from the initial state (which may be known or unknown) and then processing forward until the final state of the trellis is determined. As each received symbol is processed, the Viterbi algorithm determines which among all possible ways to get into state 1 is the most likely (given the model) and then records this path as a survivor path, and then eliminates all other paths that enter state 1 from a different path. This process is continued for state 2, determining which among all possible ways is the most likely that the system could have ended up in state 2, again keeping one state alive, ("selecting" it as part of the add-compare-select process) and eliminating all other paths to state 2. Similarly, this procedure continues to determine which are the "M" most likely "surviving paths", one into each of the M states. When the most likely path is selected, all that remains is to "trace-back" the ancestral history of that surviving path, to determine the sequence of bits that was transmitted. No survivor-path or candidate-path selection computations are done in the reverse direction: the bits are simply read off by traversing the linked list of ancestral path history from end to start.

The Forward-Backward algorithm (originally presented in the famous BCJR paper of Bahl et al. in 1974) (see no. 5 below) is a "two-pass" batch algorithm, in which in the first pass, the "forward pass" the entire block of data is processed to determine the probability that the encoder (or channel) is in state j at time n given all of the data from t=1…n, that is, Pr(state=j | data from t=1…n) is computed for every state j=1…M. In this process, rather than "add-compare-select" of the Viterbi algorithm, in which the MAX of each path into a state is kept eliminating all others, the SUM of the probabilities of each path is added together to compose the "alpha" metrics, or forward-probabilities of the algorithm. Once the forward metrics are computed, the data is processed in reverse, starting from the last observed symbol, and the backward-probabilities Pr(state=j | data from t = N…n) are computed for each j and for each n. These

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forward and backward probabilities are then combined to compute Pr(state=j at time n) for each j and each n. This information is valuable for subsequent processing, for example, in the use of Turbo Codes and Turbo Equalization (as described in our 2001 paper and our 2005 tutorial on the subject of turbo equalization). The backward processing in the BCJR or Forward-Backward algorithm described in this reference do not describe time-reverse path identification as set forth in the pending application.

3. Kuo-Ming Wu, U.S. Patent No. 7,117,426, Issued October 3, 2006.

The discussion of a backward processing algorithm in this reference is simply a standard Viterbi trace-back, as discussed in no. 1, above.

Article References:

4. Winters, Jack H., "Electrical Signal Processing Techniques in Long-Haul Fiber-Optic Systems," IEEE Transactions of Communication, Vol. 38, No. 9, September 1990, pp. 1439-1453, in particular pages 1445-1446.

This reference describes a system where the error metrics of all paths are computed in a time-forward manner, and the best path is then selected. This reference does not describe time-reverse path identification as set forth in the pending application

5. Bahl, L.R., et al., "Optimal Decoding of Linear Codes for Minimizing Symbol Error Rate," IEEE Transaction on Information Theory, March 1974, pp. 284-287.

For a discussion of this reference, see the discussion of forward and backward probabilities in no. 2, above.

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This Information Disclosure Statement is being filed:

☐ within three months of the filing date of a national application; within three months of the date of entry into the national stage as set forth in 37 C.F.R. § 1.491 in an international application; or before the mailing date of a first Office Action on the merits. 37 C.F.R. §1.97 (b)

☐ **after** three months of the filing date of a national application, or the date of entry into the national stage as set forth in 37 C.F.R. § 1.491 in an international application; or **after** the mailing date of a first Office Action on the merits, but **before** the mailing date of a Final Action under 37 C.F.R. § 1.113 or a Notice of Allowance under 37 C.F.R. § 1.311 (whichever occurs first), and includes (37 C.F.R. § 1.97 (c):

☐ the Certification under 37 C.F.R. § 1.97(e) (see "Certification" below)

OR

☐ the fee of $180.00 set forth in 37 C.F.R. § 1.17(p) (see "Fees" below).

☒ **after** a Final Action under 37 C.F.R. § 1.113 or a Notice of Allowance under 37 C.F.R. § 1.311 (whichever occurs first), but before, or simultaneously with, the payment of the issue fee, and includes the Certification under 37 C.F.R. § 1.97(e) (see "Certification" below), and the Petition Fee set forth in 37 C.F.R. § 1.17(i) (see "Fees" and "Method of Payment of Fees" below). Applicants hereby petitions for consideration of the Information Disclosure Statement submitted herewith and the accompanying references in examination of the subject patent application.

CERTIFICATION

☐ The **undersigned** hereby certifies that each item of information contained in the Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign patent application not more than three months prior to the filing of the Information Disclosure Statement.

☒ The **undersigned** hereby certifies that no item of information contained in the Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign patent application or, to the knowledge of the person signing the certification after making reasonable inquiry, was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of the Information Disclosure Statement.

FEES

☐ **No fee** is owed by the applicant(s).
☐ The **IDS Fee of $180.00** under 37 C.F.R. § 1.17(p) is enclosed herewith.
☒ The **Petition Fee of $130.00** set forth in 37 C.F.R. § 1.17(i) is enclosed herewith.

METHOD OF PAYMENT OF FEES

☐ Attached is a check in the amount of $180.00.
☒ Charge Deposit Account No. 13-2490 in the amount of $180.00. (A duplicate copy of this

communication is enclosed for that purpose.)

Please charge any underpayment or credit any overpayment in connection with this communication to Deposit Account No. 13-2490. A duplicate copy of this communication is enclosed for this purpose.

Respectfully Submitted,

Date: November 20, 2006

By: /Robert J. Irvine III/
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